SHRI MATA VAISHNAV DEVI UNIVERSITY
MECHANICAL ENGINEERING DEPARTMENT

MEL 2014   Strength of Materials   Sept., 2019

Time 1.5 Hr   MINOR   Marks 20

Note: All questions carry equal marks. Mobile phones are not allowed in the examination hall.

Q1) An assembly of a steel bar of 60mm diameter enclosed in an aluminium tube of 70mm internal diameter and 110mm external diameter is compressed between two rigid parallel plates by a force of 300 kN. The length of the assembly is 1m. Determine the stresses in the bar and the tube if $E_s = 200 Gpa$ and $E_a = 70 Gpa$.   (5,5)

Q2) At a certain point in a strained material the state of stress is (120, -90, τ). The maximum normal stress at the point is 150 MPa. Determine

    a) the value of shear stress τ,   (4)

    b) the maximum shear stress at the point,   (2)

    c) State of stress at 22.5^0 CW to the given state of stress.   (4)

Q3) A 5m long SS beam has its supports 4m apart, the overhang being on the left end. It carries a uniform load of intensity 60 kN/m. Draw the shear force and bending moment diagrams of the beam.   (4,6)

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Entry	No.	1	8	B	M	E	0	4	4

Subject: MEL 2014   SOM   **Dec. 2019**
Max. Marks: 50   Major   **Time: 3 Hrs.**

Note:
1. *Assume reasonable values of missing data.*
2. *Mobile phones are not allowed. Hand over these to the invigilation staff.*

Q1) Answer the following:

   a) Derive the relationship between Bending moment, Shear force and Load of a beam.
   b) What are the assumptions in simple beam bending theory? (3)
   c) Write the stress strain relation for 3-D state of stress. (4)

Q2) A simply supported beam 'AB' of length **L** carries a uniformly distributed load of intensity 'w' starting from a distance of **L/4** from the left end 'A' and ending **at mid-span**. Deduce the expression for slope and deflection at any point. (10)

Q3) A Cantilever beam of 6m length carries two concentrated loads of **5 kN** and **10 kN** at a distance of **2m** and **4m** respectively from the built-in end. Determine the maximum deflection by moment area method. (10)

Q4) The outer and inner diameters of a hollow steel shaft are **120mm** and **60mm** respectively. The shaft transmits **800 kW** at a speed of **400 rpm**. Determine the bending moment which can be safely applied to the shaft if the maximum principal stress is not to exceed **80 MPa**.

Q5) A **4m** long circular bar deflects **20mm** at the centre when used as a simply supported beam under a **200N** load at the Centre. Determine critical load for the same bar when used as a column pinned at both the ends. (10)

CO 1	Are able to draw internal forces diagrams of structure members.	Q2, Q3
CO 2	Have learnt to draw free body diagram of structural members.	Q1, Q2, Q3
CO 3	Are able to analysis various structural members subjected to different loads.	Q2, Q3, Q4, Q5
CO 4	Are able to calculate stress and strains of structural members.	Q4, Q5